

# Long COVID-19 Associated with 5-Fold Increase in Total Medical Costs and Greater Use of Inpatient and Outpatient Services Compared to Non-Long COVID-19: An Analysis of Real-World Data

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## Background

- COVID-19 remains an unprecedented, persistent global health emergency accounting for over 6.8 million deaths in total, and over 150,000 new cases every day worldwide.<sup>1</sup>
- Post-COVID-19 symptoms and illnesses have become a concern, as following a COVID-19 infection, the body may suffer a weakened immune system leading to prolonged or additional illness.<sup>2</sup>
- This phenomenon of post-COVID-19 symptoms has been termed “long COVID” (LC) and has been recognized as a disability under the Americans with Disabilities Act.<sup>3</sup>
- LC is associated with a wide range of debilitating symptoms and can occur among individuals who experienced a milder COVID-19 illness or who were completely without symptoms.<sup>3</sup>
- Recent evidence suggests repeated infections may increase the likelihood of LC,<sup>4</sup> though there remains a great deal to learn about LC and its sequelae.
- This study is among the first to quantify the emerging impact of LC on real-world healthcare resource utilization and expenditure.

## Objective

- To assess real-world evidence data on the prevalence and impact of LC to establish a baseline for the value of potential therapeutic interventions.

## Methods

### Data Sources

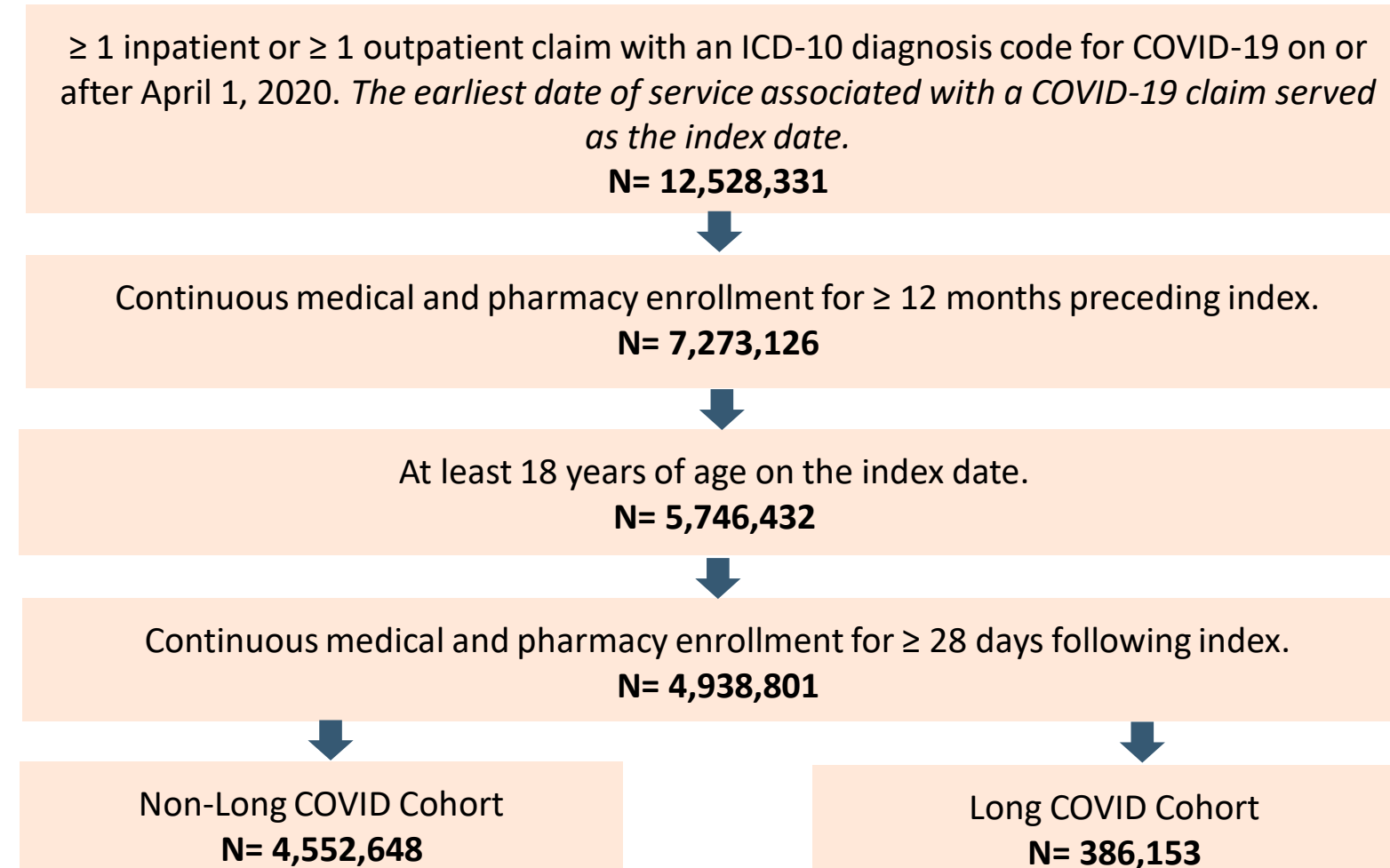
- The 100% Medicare Fee-for-Service (FFS) and the Inovalon MORE<sup>2</sup> closed claims databases of patients with Medicare Advantage, Managed Medicaid, or commercial insurance between April 1, 2020, and June 30, 2022 (Wuhan strain through omicron clinical variants) were utilized for this study.
  - The Medicare FFS data includes 100% of Medicare Part A/B medical encounters for all places of service, while the Part D Prescription Drug Event data contains all retail, mail-order, and specialty pharmacy encounters.
  - The Inovalon MORE<sup>2</sup> Registry<sup>®</sup> is a real-world medical and pharmacy closed claims database primary sourced by over 140 health plans and covers approximately 42% of the commercially insured population, 25% of the Medicare Advantage population, and 69% of the managed Medicaid population.

### Sample

- Study inclusion criteria may be viewed in [Figure 1](#).
- Patients were required to present a diagnosis of COVID-19 (ICD-10 U07.1) on or after April 1, 2020 (index date), ≥ 365 days of enrollment prior to and ≥ 28 days following index and must have been ≥ 18 years of age on the index date.
- Patients were segmented into two cohorts:
  - LC Cohort:** Appearance of at least 1 claim ≥ 28 days following the index date which includes both a COVID-19 diagnosis code and at least 1 COVID-19-related symptom.
  - Non-LC Cohort:** Absence of any claims with a COVID-19 diagnosis code ≥ 28 days following the index date.

## Methods Cont.

**Figure 1. Patient Selection**



## Outcomes

- Demographics and COVID-19 symptoms were assessed on the index date, while healthcare expenditure was assessed during the 6-month post-index period among patients with extended follow-up enrollment.
- Descriptive statistics were presented for all outcomes, and included means, standard deviations, frequencies, and proportions.

## Results

**Table 1. Patient Demographics and Baseline Charlson**

	Long COVID-19 Cohort N = 386,153		Non-Long COVID-19 Cohort N = 4,552,648	
	Mean/N	SD/%	Mean/N	SD/%
<b>Age (M, SD)</b>	67	18.97	51	20.69
<b>Age (N, %)</b>				
18-29	19,899	5.2%	893,759	19.6%
30-39	24,109	6.2%	724,816	15.9%
40-49	29,331	7.6%	640,523	14.1%
50-64	71,974	18.6%	964,473	21.2%
65-74	86,445	22.4%	660,942	14.5%
75-79	44,184	11.4%	245,615	5.4%
80+	110,211	28.5%	422,520	9.3%
<b>Sex (N, %)</b>				
Male	134,917	34.9%	1,802,796	39.6%
Female	251,236	65.1%	2,749,852	60.4%
<b>Payer Type (N, %)</b>				
Medicare FFS	227,664	59.0%	1,160,253	25.5%
Medicare Advantage	29,309	7.6%	304,781	6.7%
Managed Medicaid	67,226	17.4%	1,269,650	27.9%
Commercial	61,954	16.0%	1,817,964	39.9%
<b>Census Region (N, %)</b>				
Northeast	84,244	21.8%	771,511	16.9%
Midwest	86,958	22.5%	1,077,955	23.7%
South	154,139	39.9%	1,901,482	41.8%
West	56,904	14.7%	733,498	16.1%
Unknown	3,908	1.0%	68,202	1.5%
<b>Deyo-Charlson Comorbidity Index (Mean, SD)</b>	3.51	3.24	1.47	2.45

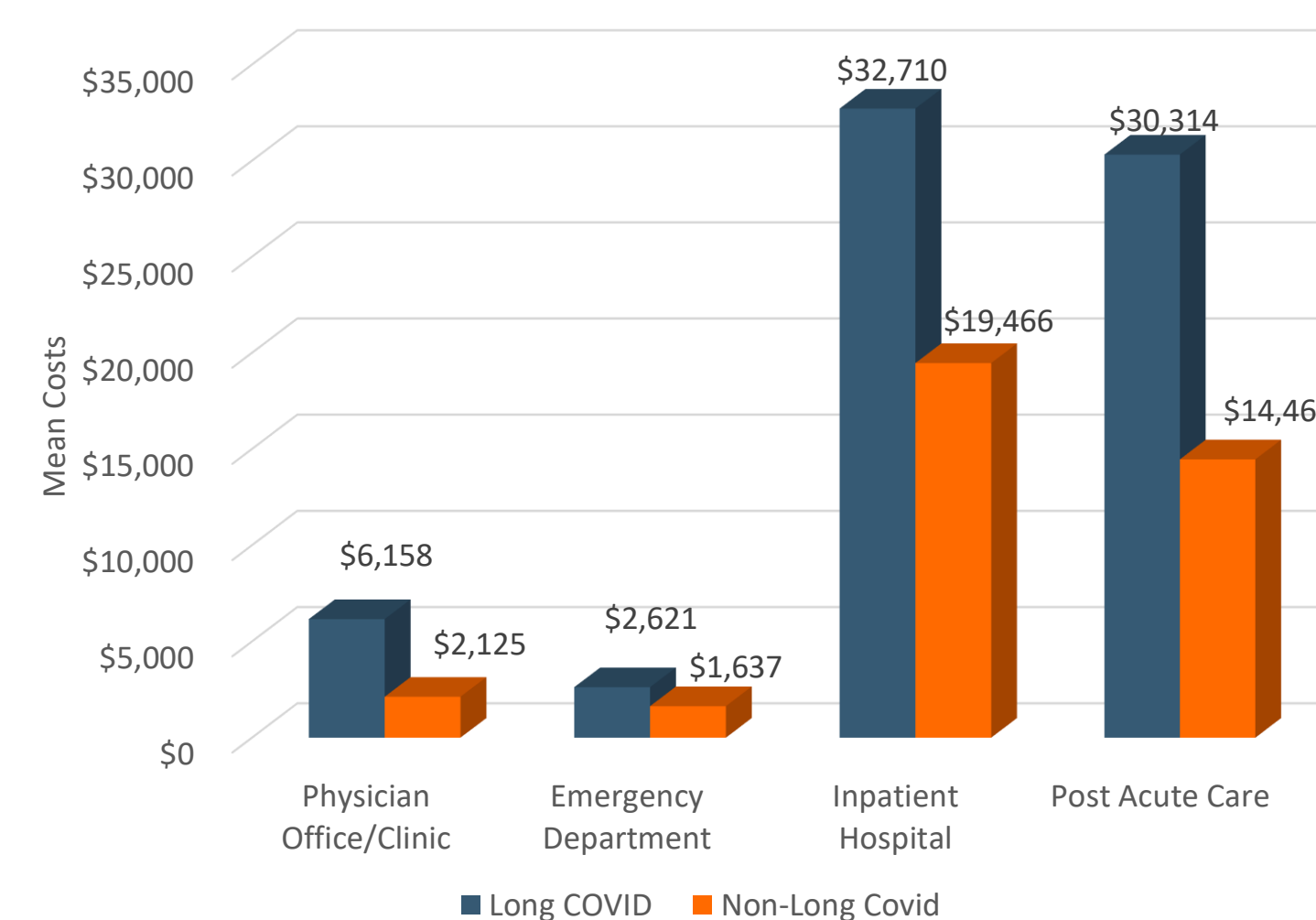
## Results

**Table 2. COVID-19 Symptoms on Index Date**

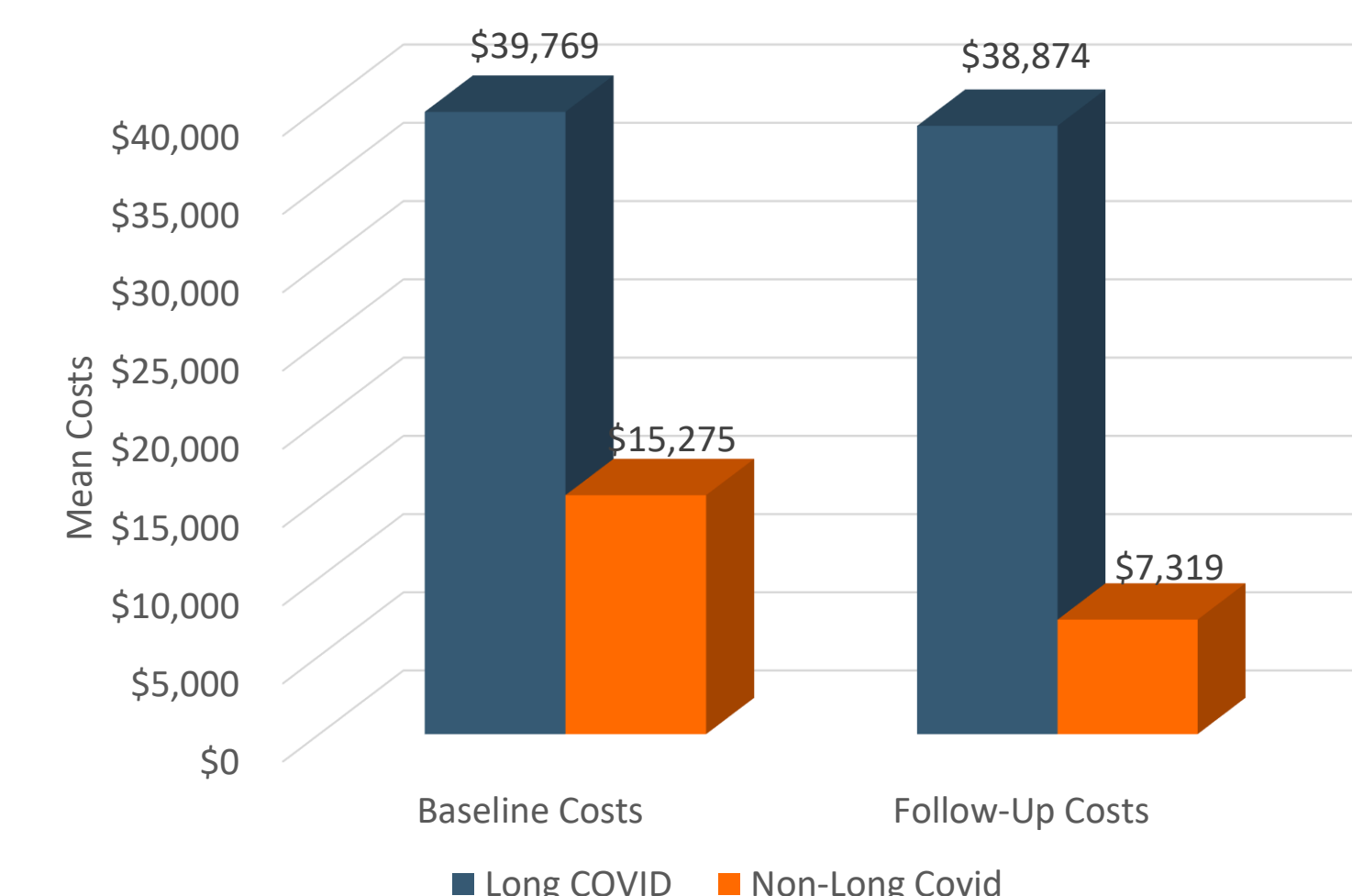
	Long COVID-19 Cohort N = 386,153		Non-Long COVID-19 Cohort N = 4,552,648	
	Mean/N	SD/%	Mean/N	SD/%
<b>Symptoms on Index Date</b>				
Ageusia	225	0.1%	1,239	0.0%
Anosmia	1,464	0.4%	35,241	0.8%
Anxiety	22,027	5.7%	91,499	2.0%
Chills/Shivering	2,233	0.6%	41,631	0.9%
Cough	51,028	13.2%	490,799	10.8%
Depression	35,453	9.2%	128,677	2.8%
Diarrhea	11,251	2.9%	93,699	2.1%
Dizziness	4,855	1.3%	44,150	1.0%
Fatigue	13,333	3.5%	168,254	3.7%
Fever	39,008	10.1%	411,410	9.0%
Headache	5,369	1.4%	44,319	1.0%
Joint pain/body aches	6,646	1.7%	70,912	1.6%
Nausea	5,582	1.4%	65,045	1.4%
Shortness of breath	44,872	11.6%	327,264	7.2%
Sore throat	6,925	1.8%	189,386	4.2%
Stuffy/runny nose	5,364	1.4%	155,444	3.4%
Vomiting	2,141	0.6%	23,692	0.5%

- Of 4,938,801 medically attended COVID-19 patients meeting inclusion criteria, 386,153 (7.8%) qualified as LC.
- LC patients were older (Mean±SD = 67.0 ± 19.0 vs. 51.0 ± 20.7), were more likely to be female (65.1% vs. 60.4%), and in poorer health as assessed by the Deyo-Charlson Comorbidity Index (3.51 ± 3.24 vs. 1.47 ± 2.45; [Table 1](#)).
- On the index date, LC patients presented a higher rate of most of COVID-19 related symptoms assessed, including anxiety (5.7% vs. 2.0%), depression (9.2% vs. 2.8%), shortness of breath (11.6% vs. 7.2%), and cough (13.2% vs. 10.8%; [Table 2](#)).

**Figure 2. Follow-Up Inpatient and Outpatient Medical Costs**



**Figure 3. Total Medical Costs – Baseline and Follow-Up**



- A total of 3,373,837 patients (68.3%) qualified for the analyses of post-index healthcare resource utilization and costs during the 180-day post-index period.
- Among COVID-19 patients with ≥ 1 visit, mean costs were greater in each service category, with LC patients incurring nearly 3-fold greater physician office/clinic costs (\$6,158 vs. \$2,125), 1.6-fold greater emergency department (\$2,621 vs. \$1,637) and inpatient hospital costs (\$32,710 vs. \$19,466), and 2-fold greater post-acute care costs (\$30,314 vs. \$14,460; [Figure 2](#)).
- Total mean medical costs for LC patients were 2.6-fold higher during the 12-month baseline period (\$39,769 vs. \$15,275), and 5.3-fold higher during the 6-month follow-up period (\$38,874 vs. \$7,319; [Figure 3](#)).

## Conclusions

- Results of the current study highlight the increased burden among LC patients compared to non-LC patients in a real-world setting.
- Patients meeting the present study’s definition of LC presented elevated rates of symptoms including anxiety, depression, and shortness of breath during time with disease, and incurred average costs of approximately \$39,000 per patient over the course of 6 months.
- Direct medical costs were > 5 times higher than costs incurred among non-LC patients, without factoring in any associated indirect costs, such as time lost from work and child/family care obligations.
- This study is one of the first to longitudinally quantify the cost and symptom burden of LC in a real-world setting and helps to establish a baseline for the value of future therapeutic interventions in development.

## References

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